

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
18 December 2003 (18.12.2003)

PCT

(10) International Publication Number  
WO 03/104693 A1

(51) International Patent Classification<sup>7</sup>: F16K 31/00  
(21) International Application Number: PCT/IB03/02151  
(22) International Filing Date: 6 June 2003 (06.06.2003)  
(25) Filing Language: English  
(26) Publication Language: English  
(30) Priority Data:  
20022699 6 June 2002 (06.06.2002) NO

(71) Applicants (for all designated States except US): ABB  
RESEARCH LTD [CH/CH]; Affolternstrasse 52,  
CH-8050 Zürich (CH). MIDTGÅRD, Ole-Morten  
[NO/NO]; Marcus Thranes gate 4F, N-0473 Oslo (NO).

(72) Inventors; and

(75) Inventors/Applicants (for US only): ASSKILDT,  
Knut [NO/NO]; Bruksveien 12B, N-1393 Vollen (NO).  
NYSVEEN, Arne [NO/NO]; Nordre Hallsetveg 99,  
N-7023 Trondheim (NO).

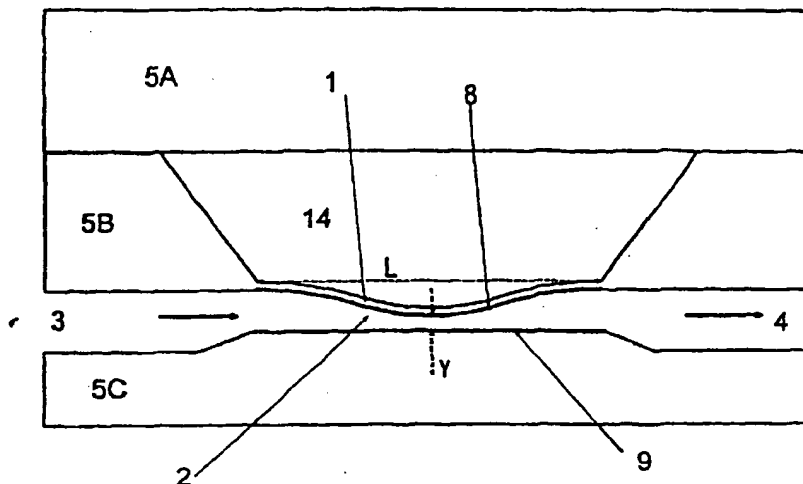
(74) Agent: DAHLSTRAND, Björn; ABB AB, Legal & Com-  
pliance/Intellectual Property, S-721 78 Västerås (SE).

(81) Designated States (national): AE, AG, AL, AM, AT (util-  
ity model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA,  
CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (util-  
ity model), DE, DK (utility model), DK, DM, DZ, EC, EE  
(utility model), EE, ES, FI (utility model), FI, GB, GD, GE,  
GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ,  
LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN,  
MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU,  
SC, SD, SE, SG, SK (utility model), SK, SL, TJ, TM, TN,  
TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,  
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,  
SE, SI, SK, TR), OAPI utility model (BF), OAPI patent  
(BF), OAPI utility model (BJ), OAPI patent (BJ), OAPI  
utility model (CF), OAPI patent (CF), OAPI utility model  
(CG), OAPI patent (CG), OAPI utility model (CI), OAPI  
patent (CI), OAPI utility model (CM), OAPI patent (CM),  
OAPI utility model (GA), OAPI patent (GA), OAPI utility  
model (GN), OAPI patent (GN), OAPI utility model (GQ),

[Continued on next page]

(54) Title: MEMS PILOT VALVE



(57) Abstract: Valve, for e.g. a pilot valve in an IP regulator, realised for example in a MEMS-structure, comprising a fluid inlet (3) and a fluid outlet (4) coupled by a fluid channel (2), all of which are defined by walls and structures (5) produced by micromachining of glass and/or silicon. An actuator (1, 8, 9) can be set to at least two different positions in order to vary the flow cross section of the fluid channel (2). The geometries of the fluid inlet, outlet and channel are adapted for preventing the flow from changing its direction so sharply that a significant portion of contaminating droplets and/or particles in the flow hit the walls of structures, as given in any arrangement according to or between the following two extremes: i) flow outlet is perpendicular to the flow inlet and the outlet dimension is larger than a critical dimension,  $L_{crit}$  estimated according to a given formula and/or as simulated in a CFD-tool (Computational Fluid Dynamics), and ii) flow outlet and flow channel is generally parallel to flow inlet giving a substantially unidirectional flow pattern.

Best Available Copy



OAPI patent (GQ), OAPI utility model (GW), OAPI patent (GW), OAPI utility model (ML), OAPI patent (ML), OAPI utility model (MR), OAPI patent (MR), OAPI utility model (NE), OAPI patent (NE), OAPI utility model (SN), OAPI patent (SN), OAPI utility model (TD), OAPI patent (TD), OAPI utility model (TG), OAPI patent (TG).

**Published:**

*with international search report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB 03/02151

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC7: F16K 31/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC7: F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 0233268 A2 (RESEARCH FOUNDATION OF STATE UNIVERSITY OF NEW YORK), 25 April 2002 (25.04.02) --	
A	US 6345502 B1 (TAI ET AL), 12 February 2002 (12.02.02) --	
A	US 6527003 B1 (WEBSTER), 4 March 2003 (04.03.03) --	
A	US 6557820 B2 (WETZEL ET AL), 6 May 2003 (06.05.03) -- -----	

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

20 August 2003

Date of mailing of the international search report

21 -08- 2003

Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

Sune Södelring / JA A  
Telephone No. +46 8 782 25 00

# INTERNATIONAL SEARCH REPORT

Information on patent family members

26/07/03

International application No.

PCT/IB 03/02151

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	0233268	A2	25/04/02	AU	1340002 A	29/04/02
				US	6592098 B	15/07/03
				US	2002043638 A	18/04/02
US	6345502	B1	12/02/02	US	6499297 B	31/12/02
				US	6536213 B	25/03/03
				US	2001014438 A	16/08/01
				US	2001017287 A	30/08/01
				US	2002062645 A	30/05/02
				AU	1522299 A	31/05/99
				WO	9924744 A	20/05/99
				US	6146543 A	14/11/00
US	6527003	B1	04/03/03	NONE		
US	6557820	B2	06/05/03	US	2002175302 A	28/11/02